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Research

## Inter-rater reliability of the AFTD-pitting test among elderly patients in a long-term medical facility

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### ABSTRACT

**BACKGROUND and AIM** : The pitting test has been reported in various methods as a standard for evaluating chronic oedema, but a unified method has not been determined. This makes it difficult to accurately specify the prevalence of oedema. The present study aimed to evaluate inter-rater reliability of the AFTD-pitting test, which included 4 factors: Anatomical locations of oedema; Force required to pit; the amount of Time; and the Definition of oedema. The present study is the first stage of an international epidemiological study of chronic oedema.

**METHODS** : This cross-sectional observational study was performed at a long-term care hospital in Ishikawa Prefecture, Japan. The inter-rater reliability of the pitting test for evaluating oedema using the AFTD-pitting test was tested for 34 locations on the body, with 10 seconds of pitting with a similar force to that of the reference rater and assessed using the modified Fukazawa method. One reference rater and four raters evaluated oedema in five patients. Then, the agreement rate and Cohen's kappa coefficient were calculated.

**RESULTS** : All protocols were completed by four raters for five bedridden patients. Agreement among the four raters was high, at  $>0.85$ , and the kappa coefficient showed almost perfect, moderate, and fair agreement for one (0.81), four (0.51-0.60) rater, respectively.

**CONCLUSION** : The inter-rater reliability of four nurses who applied the AFTD-pitting test was high, and the kappa coefficient showed at least fair agreement. Therefore, the AFTD-pitting test is a useful method to assess whole-body chronic oedema.

**KEY WORDS** : chronic oedema, AFTD-pitting, inter-rater reliability, prevalence study

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## Background

Chronic oedema is a common clinical sign of significant fluid retention, which could eventually result in a variety of conditions. This oedema lasts a long time, and patients with chronic oedema feel heaviness of the swollen body sites, limited mobility, discomfort, and decreased quality of life<sup>1-3)</sup>. Thus, management of chronic oedema requires professional health care interventions; however, these patients' health care needs have been underestimated due to a lack of evidence on the prevalence rates of chronic oedema in the world. Prevalence is an indicator for estimating the human resources and materials needed. We believe that the first priority for responding to these patients' health care needs is to determine the prevalence of chronic oedema.

Pitting is an easy physical assessment method to identify oedema: an examiner applies pressure with one or more fingers to single or multiple locations on the skin in clinical settings. However, there is no consensus on the pitting method to investigate the prevalence rate of chronic oedema. In previous reports, "the amount of time" (5-20 seconds), "the anatomical locations" (tibia, ankle, dorsum pedis, and/or oedema positions), "force of pitting" (pressing with the index finger, middle finger, and/or thumb), and "evaluation of oedema" (pitting or non-pitting) using original grading systems have been reported<sup>4)5)</sup>. These pitting methods, including definition of chronic oedema, have been reported in various methods for various purposes. With so many differing methods, it is difficult for every nurse to cause patients' skin to pit consistently every time. Thus, results of the evaluation for the "presence" or "absence" of oedema based on pitting status are not reliable due to differences in nurses' pitting methods. Therefore, the prevalence of chronic oedema based on the "presence" or "absence" of oedema is unclear. This indicates that adequately determining the care that each patient needs is difficult. No previous study has reported the reliability of its pitting methods. Thus, previous pitting methods cannot be directly adopted for a prevalence study.

An international epidemiological study for chronic oedema, called the LIMPRINT study (Lymphoedema Impact and Prevalence INTERNATIONAL), is being plan-

ned. The aim of this study is to determine the impact and prevalence of lymphoedema/chronic oedema at national and international levels. LIMPRINT is a two-phase project. Phase 1 took place between June 2013 and June 2014. During this year, the international study members prepared a manual that was necessary to undertake the prevalence study in phase 2. However, in the manual, the method of pitting to evaluate oedema was not described in detail. Therefore, standardization of the pitting methods is needed for the international prevalence study.

Thus, the present study is the first stage of an international epidemiological study of chronic oedema. The AFTD-pitting test was developed to evaluate oedema, including 4 factors: Anatomical locations of oedema; Force required to pit; the amount of Time; and the Definition of oedema.

## AIM

This present study aimed to examine the inter-rater reliability of the AFTD-pitting test for evaluating chronic oedema.

## AFTD-pitting test

First, a consensus meeting was held, and the four factors were selected by 12 members, including a chief investigator of the LIMPRINT study, nursing researchers involved in oedema care, a nursing specialist for lymphoedema management, and general nurses. AFTD is an acronym derived from the four factors: the A indicates the Anatomical locations of oedema assessment; F is the Force required to pit; T is the amount of Time; and D is the Definition of oedema.

Thirty-four anatomical locations for oedema assessment were chosen because oedema can occur at any site throughout the whole body; therefore, members selected prediction sites throughout the whole body and decided to assess at least 34 sites (**Fig. 1**). The force required to pit was determined using the thumb, as the area is stable and fixed every time. The amount of time selected was 10 seconds measured by a timer to facilitate clear assessment (**Fig. 2**). For the definition of oedema it was decided to use the modified Fukazawa method (**Table 1**)<sup>6)</sup> for investigation of the degree of oedema severity. Patients with Grades 2, 3, and

<input type="checkbox"/> Head	<input type="checkbox"/> Vulva	<input type="checkbox"/> L fingers	<input type="checkbox"/> L toes	<input type="checkbox"/> R fingers	<input type="checkbox"/> R toes
<input type="checkbox"/> Face	<input type="checkbox"/> Scrotum	<input type="checkbox"/> L hand	<input type="checkbox"/> L foot	<input type="checkbox"/> R hand	<input type="checkbox"/> R foot
<input type="checkbox"/> Eyes	<input type="checkbox"/> Penis	<input type="checkbox"/> L lower arm	<input type="checkbox"/> L lower leg	<input type="checkbox"/> R lower arm	<input type="checkbox"/> R lower leg
<input type="checkbox"/> Lips		<input type="checkbox"/> L upper arm	<input type="checkbox"/> L upper leg	<input type="checkbox"/> R upper arm	<input type="checkbox"/> R upper leg
<input type="checkbox"/> Cheek		<input type="checkbox"/> L shoulder	<input type="checkbox"/> L buttocks	<input type="checkbox"/> R shoulder	<input type="checkbox"/> R buttocks
<input type="checkbox"/> Tongue		<input type="checkbox"/> L upper chest/breast	<input type="checkbox"/> L abdomen	<input type="checkbox"/> R upper chest/breast	<input type="checkbox"/> R abdomen
<input type="checkbox"/> Neck					

Fig. 1 34 anatomical locations for the pitting test

Raters focused on oedema locations from patient histories related to 34 locations. They assessed the presence or absence of oedema for each patient and checked all that applied.

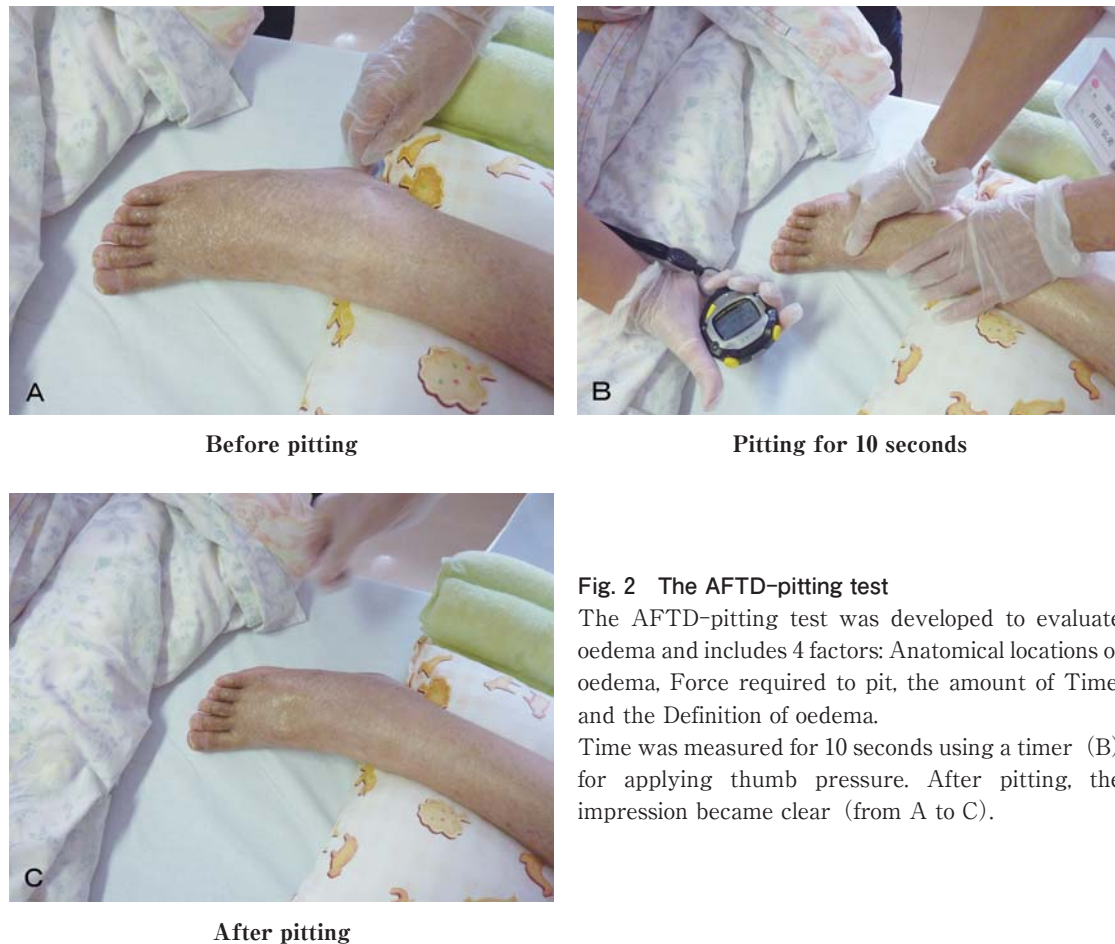


Fig. 2 The AFTD-pitting test

The AFTD-pitting test was developed to evaluate oedema and includes 4 factors: Anatomical locations of oedema, Force required to pit, the amount of Time, and the Definition of oedema.

Time was measured for 10 seconds using a timer (B) for applying thumb pressure. After pitting, the impression became clear (from A to C).

non-pitting oedema in any of the 34 sites were defined as having oedema.

## METHODS

### Raters

Four different nurses from three hospitals located in Kanazawa were recruited to serve as volunteer raters for the reliability test. They had experience examining and treating patients with a variety of oedema conditions. Raters had clinical experience with oedema

care ranging from 5 or 6 oedema per month to 11 years, and they treated (Table 2).

### Study design

The raters were introduced to the purpose of the study and instructed in the use of the AFTD-pitting method in the LIMPRINT study. Then, the reference rater provided a 30-min explanation of how to assess the presence of swelling by the pitting test at the bedside (Fig. 3). The reference rater was the chief investigator for the LIMPRINT study, an expert in chronic oedema

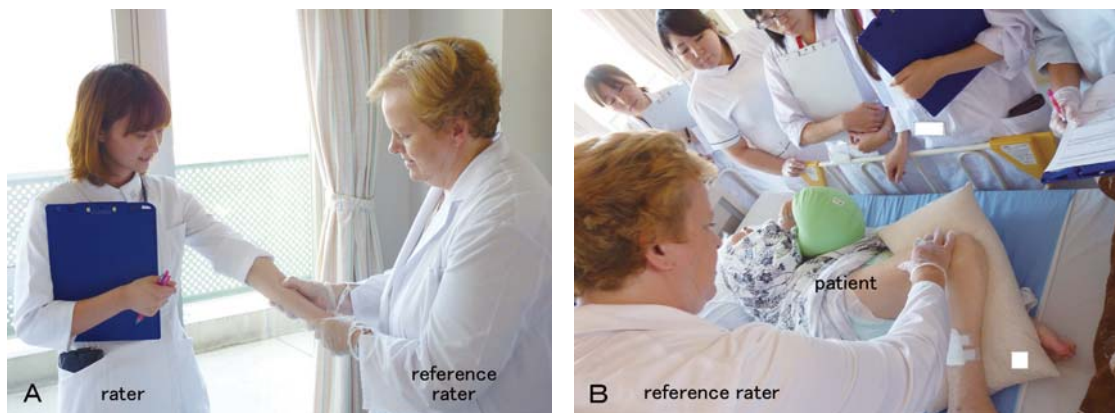
**Table 1 Modified Fukazawa method**

Grade	Criteria
0	There is no impression
1	Impression of the outline of the dimple is slightly differentiated by release of pressing, and sometimes seems to be missing
2	Impression does not become clear at the beginning of the pressure, but occurs with further pressure, and an impression is left after release
3	Deep impression remains after release of pressure that is clear on visual inspection and palpation at initiation of pressure
NPE Indentation made by pressure on the affected area does not persist (non-pitting oedema)	

The original Fukazawa method is from grade 0 to grade 3. In this study, “non-pitting oedema (NPE)” was added to the original Fukazawa version. Grade 2, 3 and NPE were defined as oedema.

**Table 2 Rater characteristics**

Raters' ID	Average no. of oedema treated per month (cases)	Oedema care experience (years)	Job experience (years)
1	5	3	3
2	6	11	16
3	5	3	3
4	6	1	10

**Fig. 3 Training of the raters by the reference rater**

The reference rater trained all raters on the force of pitting and the assessment of the “presence” or “absence” of oedema by demonstrating on each rater (A) and a patient (B).

with considerable experience in oedema management and research.

The inter-rater reliability of the pitting test for oedema evaluation was investigated. The four raters were divided into three groups. Three groups visited 5 patients in turn to assess current swelling status by inspection and palpation at the bedside. Patients who had chronic oedema of at least one location for over

three months at a long-term care hospital ( Sengi Hospital, Ishikawa Prefecture, Japan ) were assessed. Patients were excluded if they were unable to tolerate the test procedures for 30 minutes. Each group assessed one patient within 7 min.

#### Analysis

Percent agreement and the kappa coefficient were used to estimate inter-rater test reliability. The kappa



**Table 3 Patient characteristics**

Items/Case	A	B	C	D	E
Age (years old)	91	93	83	88	82
Sex	Female	Female	Male	Female	Female
Main disease	Subarachnoid hemorrhage	Multiple cerebral infarction	Post cerebral hemorrhage	Post cerebral hemorrhage, ischemic heart disease	Cerebral infarction
Activity	Bedridden	Bedridden	Bedridden	Bedridden	Bedridden
Mobility	Immobile	Immobile	Immobile	Immobile	Immobile

**Table 4 Inter-rater reliability of the pitting test**

Rater ID	Agreement rate with reference nurse	Cohen's kappa coefficient
1	0.88	0.51
2	0.90	0.60
3	0.94	0.81
4	0.88	0.51

coefficient ranges from -1.0 to 1.0, and, in the present study, represents agreement beyond the chance agreement of presence or absence of oedema for the 34 anatomical locations in the five patients. When calculating the kappa coefficient, the formula described by Fleiss<sup>7)</sup> was used, in which the raters responsible for rating one subject are not assumed to be the same as those rating another subject.

### Ethical considerations

The Ethics Committee at Kanazawa University approved the protocol, and all participants provided their written, informed consent to participate in the study.

## Results

All protocols were completed by the four raters for the five bedridden patients, who were all over 80 years old (Table 3).

Agreement among the four raters was high, with all raters showing agreement over 0.85. The kappa coefficient was 0.81 for one, 0.51–0.60 for three (Table 4).

## Discussion

To undertake an international epidemiological study of chronic oedema, a consensus AFTD pitting test was

developed, and its reliability was tested. The agreement rate among the four raters was over 0.85, and the kappa coefficient was at least 0.51.

The agreement rate among the four raters was over 0.88, with rates being considered perfect at 0.81–1.00, substantial at 0.61–0.80, moderate at 0.41–0.60, fair at 0.21–0.40, slight at 0.00–0.20, and poor at 0.00<sup>8)</sup>. Therefore, the agreement rate in the present study was almost perfect. Although the raters' oedema care experience ranged widely, all achieved high agreement rates (0.88–0.94). However, these results might have been affected by their pre-study training before collecting the data. A previous study reported that inter-rater reliability was not good despite decisions related to time, anatomical locations, and force using a plastic oedema tester<sup>9)</sup>. The reason for poor reliability might have been that it was difficult to maintain a constant pressure for three seconds with the tester and that the examiners did not have pre-study training. Thus, training before collecting data for the prevalence study is very important.

While the agreement rate was high with the AFTD-pitting test in this study, the kappa coefficient was fair except for one rater. The kappa coefficient of rater "ID 3" was 0.81. Others showed kappas of 0.51–0.60. The reason for the differences may be that, in several areas, the raters rated oedema as "absent", even though the reference rater rated it as "present". There is a reason for these differences. This result suggests that the raters in the epidemiological study will need advanced knowledge and skills related to chronic oedema as oedema cases treated per month. During the educational lecture, the reference rater suggested that all raters consider the pitting location from the patients' history.

Therefore, raters might have given priority to locations based on the patients' history. However, even though the raters had limited time (just 7 minutes) to assess each patient, this study exhibited good results in the clinical setting.

There is a limitation in this study with respect to external validity. Because this reliability study was conducted at a long-term care hospital, most of the oedema was caused by immobility. Thus, these results could not be generalized to other kinds of oedema, such as lymphoedema characterized by non-pitting oedema. The pathophysiology of chronic oedema following immobility and lymphoedema that occurs due to accumulation of protein-rich fluid is different.

### Conclusion

The inter-rater reliability of four nurses who applied the AFTD-pitting test was high, and the kappa coefficient showed at least fair agreement. Therefore, the AFTD-pitting test is a useful method to assess whole-body chronic oedema.

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# 長期療養施設入所中の高齢者に対する慢性浮腫評価のための AFTD-Pitting テストの評定者間信頼性

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## 要 旨

【目的】圧痕テストは浮腫評価方法として標準的技法ではあるが、統一された手法はなく浮腫有病率を正確に算出する上で課題である。国際疫学研究“LIMPRINT”を行う第一段階として、the Anatomical locations of oedema（部位）、Force required to pit（圧力）、the amount of Time（時間）、Definition of oedema（浮腫の定義）、を統一したAFTD-pitting テストを用いて、慢性浮腫評価に対する評定者間信頼性を検証した。

【方法】本研究は横断観察研究であり、石川県内の長期療養型病院1施設で実施した。浮腫を有する高齢者5名に対し、4名の評定者が評価した。評定者は全員看護師で、エキスパートである1名をゴールドスタンダードとし、4名の評定をエキスパートと比較し、一致率及びCohen's  $\kappa$ 係数を算出した。評定者は母指で10秒間、対象者の身体のうち特定の34部位を圧痕テストして浮腫の有無を評価した。圧力はエキスパートと一致するよう事前演習を行い、深沢変法を用いて浮腫の有無を評価した。本研究は、金沢大学医学倫理審査委員会の承認を得て実施した。

【結果】評定者は、浮腫管理を月に5～6症例実施している看護師で、リファレンス評定者は国際疫学研究“LIMPRINT”の統括者で慢性浮腫の看護ケア・研究のエキスパートであった。患者対象者は全員80歳以上で、日常生活に看護・介護が全面的に必要な寝たきりの者であった。4名の評価者とエキスパートとの評定者間一致率は0.85以上であり、Cohen's  $\kappa$ 係数は1名が高い一致（0.81）、3名が中等度の一致（0.51から0.60）であった。

【考察・結論】AFTD-pitting テストの評定者間信頼性は高い一致率と良い $\kappa$ 係数であった。AFTD-pitting テストは浮腫有病率調査に有用な方法であることが示唆された。

**キーワード：**慢性浮腫、AFTD-Pitting テスト、評定者間信頼性、有病率調査